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FRANKFORT KENTUCKY 40601
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February 27, 2012

Jessamine – South Elkhorn Water District
Attn: Chairman, L. Nicholas Strong
802 S. Main Street
Nicholasville, KY 40356

RE: Jessamine – South Elkhorn Water District
AI # 33936
Northwest Watermain & Dixon Town
Waterline Replacement GPR

Dear Mr. Strong:

Thank you for submitting a Green Project Reserve Business Case for the Northwest Watermain & Dixon Town Waterline Replacement project, funded through the DWSRF program. A provision of the 2012 DWSRF capitalization grant requires that to the extent there are eligible project applications; states shall use 20% of its Drinking Water State Revolving Fund capitalization grant for green infrastructure projects. These projects are intended to address water and energy efficiency improvements or other environmentally innovative activities. The Kentucky Division of Water (KY DOW) has reviewed the business case provided for the Northwest Watermain & Dixon Town Waterline Replacement project. All items presented were determined to be acceptable with a construction cost of \$3,025,300. If the scope of the project is altered in any way to exclude the GPR eligible components, Jessamine – South Elkhorn Water District shall submit the changes in writing to the KY DOW and receive prior approval in writing before proceeding with construction.

We look forward to working with you in finalizing your wastewater infrastructure project. If you have any questions regarding this correspondence, please contact me at (502) 564-3410, ext 4832.

Sincerely,

Greg Goode, P.E.
Water Infrastructure Branch
Division of Water

WATER SYSTEM IMPROVEMENTS
NORTHWEST WATERMAIN REPLACEMENT &
HYDRAULICS/DIXON TOWN WATERLINE
REPLACEMENT PROJECT
BUSINESS CASE FOR GREEN PROJECT RESERVE FUND

JESSAMINE-SOUTH ELKHORN WATER DISTRICT
802 S. MAIN STREET
NICHOLASVILLE, KY 40356

DECEMBER 2011

Prepared by:

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EXECUTIVE SUMMARY

The Jessamine-South Elkhorn Water District has submitted a project that focuses on its water distribution system as a whole. Given the nature of the project, there are several components of the project that qualify under Water Efficiency with resultant spinoffs of Energy Efficiency. As presented herein, the project will result in the following.

- Line replacement will provide a means toward significant reduction in water losses of an estimated annual cost of \$150,000. Also, a significant reduction in line repair cost of an estimated average annual cost of \$38,000. 2.5-1
- Line looping will greatly increase the District's water quality and a significant reduction in the estimated average annual cost to the District of approximately \$900. 4.2-1b
- Meter replacement of the antiquated meters, all of which were installed during the 1970s. Initial test results indicated that most, if not all, are registering slow by 5% - 10%. Also, none are equipped with internal backflow prevention devices. These problems will be resolved with new metered services. 2.5-2
- Valving configuration and spacing on the 1972 installation is sparse and very inefficient as regards line repair isolation resulting in an inordinate number of customers experiencing shut downs and increased water loss. This problem will be essentially eliminated with the line replacement. 2.5-3
- The implementation of the above categories will result in reduction of manpower and energy, as well as total carbon emission.

These factors correspond to several project requirements as described within the Water Efficiency and Energy Efficiency Project categories. Therefore, the herein above various noted components of the project meet the Green Project Reserve requirements, thereby qualifying those components of the project as "Green."

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**Water System Improvements
Northwest Watermain Replacement & Hydraulics/Dixon Town
Waterline Replacement Project
Business Case for Green Project Reserve Fund
December 2011**

INTRODUCTION

The Jessamine-South Elkhorn Water District has recently been prioritized to receive a State Revolving Fund loan for drinking water in the amount of \$3,025,300. This project proposes to replace and upsize that portion of the District which was originally piped in 1972 and is currently experiencing numerous line breaks and water outages. Replaced lines will be upsized where required. In addition, some of the existing stub mains will be extended to create appropriate looping configurations, thus increasing flow, residual peak flow pressure and water quality. Original meter services will be replaced with new service employing integral black flow preventors. In addition this project will replace, upgrade and provide fire protection to the residents in the small community of Dixon Town in northwestern Jessamine County. Frequent breaks and undersized lines have plagued this area for years. The project would modernize the system and correct deficiency issues. Of the \$3,025,300, the entire amount is proposed as eligible as Green Project Reserve. This memorandum has been prepared to further detail the information requested by the Kentucky Division of Water to justify the project as a Green Project Reserve.

PROJECT BACKGROUND

Of the components which comprise the proposed project, all are considered to be eligible for Green Project Reserve funding. Those primary project components are:

1. Replacement of original 1972 line installation.
2. Completion of line loopings to eliminate water quality problems.
3. Replacement of antiquated meters and installation of backflow preventors.
4. Installation of additional valving to provide for line isolation.

The estimated cost of the proposed loan is \$3,025,300, including construction, engineering, planning, distribution modeling, planning studies, and administration costs of which the entire amount is projected to qualify for Green Project Reserve.

COMPONENT

Line Replacement - The original construction of the Jessamine-South Elkhorn Water District distribution was completed in 1972. The bulk of the line size for this original construction consisted of 4" pipe. The system was originally designed to primarily serve a rural farm situation and subsequent years have seen a rapid growth of high-density residential development. Consequently, there was a period that the District experienced severe pressure problems which were alleviated, at that time, with the introduction of greater

development. Consequently, there was a period that the District experienced severe pressure problems which were alleviated, at that time, with the introduction of greater pumping capacity and parallel piping in some instances. Presently, the District is experiencing an ever-increasing cost, related to repair of line leaks. This cost is not only associated with the actual repair cost, but also it is exacerbated by the loss of water before and during the leak repair. Insofar as the District depends solely on purchase of water, this cost is increased over what would normally be associated with the lower production cost should the District be a producer of their water.

Appendices A and B contain the actual invoices of the District's maintenance contractor on which the cost for various leak repairs are documented. These costs have been tabulated in Tables A and B, and reflect a total annual repair cost of:

Year	Monthly Average	Annual Total
2010	\$3,648.22	\$43,778.64
2011	\$4,645.36	\$55,744.30

The 2011 figures are summarized as a 10-month period from January to October and for the purposes of this study have been extrapolated to an annual basis by proportional increase to a 12-month period. The total cost for both of these years cannot be attributed solely to that portion of the District of the original 1972 line placement. However, a visual review of the documented location of the repair points and the historical knowledge of the District's system would support the fact that of this annual total, a minimum of 75% of this cost can be directly attributed to the 1972 pipe. Therefore, the direct cost attributable to the proposed replacement project would be :

Year	Annual Total	Attributable Total
2010	\$43,778.64	\$32,833.98
2011	\$55,744.30	\$41,808.23

With replacement of this piping, one could then anticipate an annual savings of \$32,833.98 - \$41,808.23, or an average estimated savings of \$38,000.

Associated with the 1972 piping and the cost of repair of leaks in the system is the actual line losses that are experienced. It is recognized in the industry that not all leaks are repaired, and in most cases, significant leaks will exist for a long period of time before they are discovered and repaired. In order to evaluate the effect of the age of the system in regards to the proposed replacement of the original piping, this study has conducted a review and tabulation of the line losses for the District. Appendices C and D contain the monthly report by staff of water losses for the entire District including what is termed the Northwest portion and the Southeast portion. The values of each of these areas of service are separated and the project in review here deals solely with the Northwest portion of the District. Tables C, C1 and D,

D1 are tabulations of information contained in these monthly reports. Tables C and D are a tabulation by month by the calculated line loss by staff which is taken from the entirety of their monthly reports. Staff attempts to adjust the actual loss by including documented or estimated accounted for losses and results in the percentage losses that are shown in the percentage column. Also, the cost to the District has been calculated by multiplying the cost of purchase of water from the Kentucky American Water Company (which is the supplier) times the documented line loss and those are tabulated.

Tables C1 and D1 utilize the documented purchased volume of water and the documented sold volume of water, and then calculates the differences as being the loss, which does not include any of the accounted for volumes. The purposed of doing this is to reflect the actual cost to the District which must purchase the water, and the amount that is not sold and the revenue collected, is then in effect a loss revenue to the District. Those total annual values are represented as follows:

Year	Line Loss (gallons)	Percentage	Annual Cost
2010	51,565,680	16.85%	\$168,654.33
2011	54,663,432	21.07%	\$230,096.42

Again, as was discussed in the cost to the District for line repairs, it cannot be stated that this entire cost is attributable solely to that portion of the system that contains the original 1972 pipe installation. However, as with the lien repair cost, the reasonable factor that can be attributed to the direct cost on leakage to that original portion of the District would be 75%. Therefore, the direct cost attributable to water leakage for this replacement of the system would be:

Year	Annual Cost				Direct Cost Attributable
2010	\$168,654.33	X	75%	=	\$126,490.78
2011	\$230,096.42	X	75%	=	\$172,572.32

This then results in an expected range of reduction in the operating costs to the District that would vary in the possible range of \$126,490.78 - \$172,572.32 or an expected estimated annual average of \$150,000.

Appendix I contains a graph of the adjusted line losses as represented by the staff's monthly reports for the time period of 2010 and 2011. Both of these years are graphed concurrently and from this juxtaposition of the years reveals some interesting points. Firstly, the general shape of the graph in both years is essentially the same, the difference being in the percentage of the line loss. Secondly, there are some drastic differences between months that show a substantial change in absolute value of the percentage loss, but this can be attributed to the manner of the timing in which the master meter for the purchased water is read versus the date on which the total consumption is determined by reading of the customer's meter.

Line Looping - The original design of the distribution system for the Jessamine-South Elkhorn Water District was what is termed a "Christmas Tree System". When viewed on a distribution map, this is quite apparent in that the system is typically a main trunk line and then from it branch out radially and terminate at the end of where service is required. Typically, there is minimum, if not absence of any looping of mains in this type system. This then results in an increase cost to the system, insofar as that without adequate usage by the customers it can result in stale water having a low chlorine concentration and in some cases, objectionable odor and taste. The remedy for this situation is to periodically flush the system by removing the stale water and reintroducing fresh chlorinated water. This, of course, not only results in a cost to the District in the manpower required for the flushing, but also the cost of the water loss which it had purchased. An alternate means of alleviating this problem is to loop these dead-end lines such that there is constant circulation within the system which in turn replaces the usage with fresh water.

Throughout the history of the system, the District has made attempts to eliminate these dead-end lines by constructing looping patterns as the system has been expanded or in efforts to improve hydraulic functions. However, there are still areas of the District that have dead-end mains, and this project proposes to eliminate a significant portion of these by construction loop lines to eliminate these dead stubs.

Appendices E and F contain Tables E and F which are tabulations of instances where District personnel have been required to flush these dead-end lines within the Northwest portion of the system. The calculated amount of water that has been utilized for these flushing operations are:

Year	Line Flushing (gallons used)
2010	100,500
2011	124,200

Tables E and F also contain a tabulation of the attributable cost to the District for completing these flushing operations, not only to manpower, but also the cost of lost water. Those costs are as follows, with an estimated annual average of \$900.

Year	Line Flushing Annual Costs
2010	\$861.00
2011	\$989.00

Meter Replacement - The original installation of meters completed under the construction of the 1972 system consisted of copper setters which did not contain integral back flow devices. The District has an increased concern over public health and protection, and to that end did initiate a policy that all new copper setters and services to be installed must contain an integral dual check backflow preventor. This project not only proposes to install new services that will contain this integral backflow device, but it also will remove from the system antiquated meters that have been demonstrated to be a detriment due to the accuracy of which the customer use is calculated.

Appendices G and H are copies of actual meter test accuracies that have been conducted on a sampling of meters within the Northwest Service Area. Tables G and H are summations of averages of these tests that are broken down by meter sizes. These tests and tables represent a population test of 237 meters in 2010 and 170 meters in 2011. The annual average of these test results during these time periods are:

Year	Fast %	Medium %	Slow %
2010	96.4%	95.3%	79.1%
2011	95.5%	95.9%	88.6%

The accuracy limits for various size meters are unchanged with the exception of the Slow test flow. Also, the Slow test is in the range of 1/4 gpm for the 5/8" x 3/4" meter to 4gpm for the 3" meter. Consequently, the accuracy differential that relates to the Slow flow would be of a minimal concern to the overall error that one would anticipate in the Medium to Fast range which reflects a permitted accuracy range of 98.5 to 101.5. The comparison of this accuracy range to the actual average of the meter readings reflects that even from the minimum accuracy range that there is an error differential of 2% - 3%, and an estimated annual average of 2.5%, slow.

Utilizing the volume of sold water as taken from Tables C-1 and D-1 and applying the average error for each meter, as 2.5% slow, this results in unmeasured use of water in the amounts and represented by the loss revenue as shown following:

Year	Water Sold	Unmeasured Water	Loss Revenue
2010	215,977,370	564,945	\$1,850
2011	204,803,510	512,010	\$2,155

The cost to the District for antiquated and inaccurate meters represents a revenue loss of approximately \$2,000 per year. Coupled with the replacement of these antiquated meters the District has determined that they will initiate a testing program that will assure that each meter will be tested and/or replaced within the ten (10) year cycle that is required by the Kentucky Division of Water regulations.

that substantial portions of the District have to be shut down in order to isolate the break for repair. This also has been exacerbated when looping of end lines have occurred and the original valving on the "christmas tree" system consisted of a single valve on the branch and did not provide for valving on the main line which would then allow for 3-way valving junctures which permit shutoff and redirection of flow through connecting loops thereby minimizing the amount of outages.

Traditionally, in the early design of these rural type systems, there are situations where almost the entire system has to be shut down in order to fix a leak. Fortunately, the Jessamine-South Elkhorn Water District through its extension processes has been able to include some additional valving on the new service that precludes the isolation shut downs for these newer areas. However, the older section is still bare of sufficient valving for efficient shutdown. Therefore, this proposal proposes a component of additional valving on the new lines as they are installed which will then allow for a greater efficiency in line shutdown and minimizing the amount of water loss and disruption to customer service during periods of repairs.

This report does not purport to have conducted an extensive valve location survey to have calculated the anticipated annual savings to the District by being able to significantly reduce the amount of water loss due to inadequate valve spacing. However, it is reasonable to assume, based on the average number of leak repairs that a savings of \$1,200 annually would be reasonable.

ENERGY EFFICIENCY COMPONENT

This report does not purport to base justification of the Green Project Reserve on Energy Efficiency. However, it would be remiss not to point out those components of Energy Efficiency increases that are directly due to the Water Efficiency practices that are proposed.

Electrical Energy Reduction - Every gallon of water used by the District's customers must be pumped from the supply source with Kentucky American Water Company. This is accomplished via pumps rated at 660 gpm, which utilize electrical energy.

The line loss leakage is an item that is not only a loss of revenue source to the District, but it is also a liability cost to the District both in purchase and pumping. For pumps rated at 660 gpm, it takes 1263 hours to pump 50,000,000 gallons, which represents an average annual line loss. Not only is there potential savings of electrical energy cost, but the pump's lifetime usability can be expected to be increased by 10% - 20%.

Vehicle Use & Manpower - Flushing and leak repairs involve inordinate amounts of manpower. Also, mechanical energy powered by fossil fuels, involving excavation equipment and vehicles. The fossil fuel equipment and vehicles used are historically low efficient users of fuel resulting in an inordinate amount of volume to use ratio with consequentially much higher volume of carbon emissions.

Each trip, for leak repair or flushing, that this project eliminates will go toward a savings in fuel use and carbon emissions. One small step, but when applied collectively across the nation will result in a substantial change

CONCLUSION

This report documents and confirms that the project as proposed will result in a significant reduction in lost water and revenue resulting in a positive increase to the net profit potentially for the District.

The anticipated savings to the District are:

Replacement		\$188,000
Leak repairs	\$ 38,000	
Loss water cost	\$150,000	
Flushing cost		\$ 9,000
Unaccounted metering		\$ 2,000
Line loss - valving		<u>\$ 1,200</u>
Total Revenue Increase		\$200,200

Completion of this project, projects an annual savings to the District the estimated amount of \$200,200.

LETTER OF TRANSMITTAL

email@horneeng.com

HORNE ENGINEERING, INC.
216 SOUTH MAIN STREET
NICHOLASVILLE, KY 40356
Ph. (859) 885-9441

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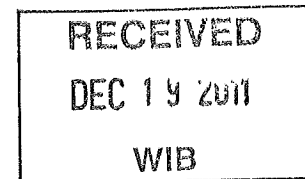
To: Amanda Yeary, Environmental Tech
Kentucky Division of Water
Department for Environmental Protection
200 Fair Oaks Lane, 3rd Floor
Frankfort, KY 40601

Date: December 14, 2011

Re: Northwest & Dixon Town Waterline Replacement
Project (WX21113029 & WX21113039)

WE ARE SENDING YOU ATTACHED:

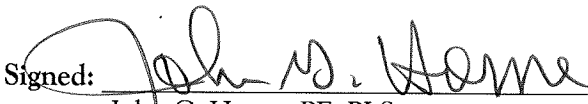
COPIES	DATE, W.O. # and/or DWG. #	DESCRIPTION
1	#3868	Green Project Reserve - Northwest & Dixon Town Waterline Replacement Project (WX21113029 & WX21113039)



THESE ARE TRANSMITTED as checked below:

<input type="checkbox"/> For approval	<input type="checkbox"/> Approved as submitted
<input type="checkbox"/> For your use	<input type="checkbox"/> Approved as noted
<input type="checkbox"/> For your records/files	<input checked="" type="checkbox"/> As requested/ required
<input type="checkbox"/> Other:	<input type="checkbox"/> For your review

COMMENTS:

Signed: 
John G. Horne, PE, PLS
President

cc: Board of Commissioners
Engr/3868
Engr/3933
Corr.